

### ABSTRACT OF THE DISCLOSURE

A pulsed dc reactive magnetron sputter deposition apparatus and process enables large substrates to be coated with one or more sputter cathodes having a size smaller than the substrate. The reactive sputtering is provided over a long throw distance between the sputter cathode and the substrate, and approximating a long mean free path. The substrate to be coated due to the low pressures enabled by the use of pulsed DC magnetrons. The low pressures, e.g. less than 1 mTorr, allows for a long throw distance which approximates the long the mean free path. And a pulsed dc power source provides sufficient energies to emit sputtered target particles across the long throw distance to the substrate substantially without collision, to produce optical coating with optics grade qualities.